DOCUMENT RESUME

ED 054 129 SP 007 328

TITLE	Science Experience Unit: Conservation.
INSTITUTION	Ferguson-Florissant School District, Ferguson, Mo.
PUB DATE	Sep 70
NOTE	46p.
EDRS PRICE	EDRS Price MF-$0.65 HC-$3.29
DESCRIPTORS	*Conservation Education, *Curriculum Guides, *Environmental Education, *Intermediate Grades

ABSTRACT

GRADES OR AGES: Intermediate grades. SUBJECT MATTER: Conservation. ORGANIZATION AND PHYSICAL APPEARANCE: The guide is divided into 24 experiments. It is mimeographed and staple-bound with a paper cover. OBJECTIVES AND ACTIVITIES: A specific skill or knowledge objective is stated at the beginning of each experiment. Detailed procedures are listed for each experiment, with numerous illustrations provided. Activities are about equally divided between laboratory experiments and field experiments and observations. INSTRUCTIONAL MATERIALS: The guide contains lists of books, films, charts, and illustrations for use in identifying insects and trees. STUDENT ASSESSMENT: No mention. (RT)

ED054129

September, 1970

SCIENCE EXPERIENCE UNIT:

CONSERVATION

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CONSERVATION PLEDGE

I GIVE MY PLEDGE AS AN AMERICAN

TO SAVE AND FAITHFULLY DEFEND FROM WASTE

THE NATURAL RESOURCES OF MY COUNTRY--

ITS SOIL AND MINERALS, ITS FORESTS, WATER, AND WILDLIFE.

INTRODUCTION

CONSERVATION means many things to many people. It means far more than conserving, preserving, or guarding natural resources. Soil, water, forests, grasslands, fish, and wildlife are all renewable resources. Conservation is concerned with preserving, restoring, and managing them so they will remain continuously productive and continuously available. Coal, petroleum, natural gas, and minerals on the other hand, are not renewable resources. These we cannot restore, but we can use them wisely by eliminating waste and improving the efficiency of their extractions, processing and use.

Conservation education is not a separate course or area of study, but simply one way of stressing the wise use of natural resources in the existing school courses.

Developing a conservation program in a school or classroom just doesn't happen. Like doing anything important, teaching conservation in the classroom takes sound planning and good preparation. Many of the basic concepts are already found in subjects being taught.

Since elementary children are curious about nature and the out-of-doors, you can capitalize on these interests to make learning more interesting and meaningful for the student by relating classroom learnings to outdoor subjects. Social Studies comes alive when we relate our natural resources to those of other countries and Art becomes more meaningful when we know why a tree branches the way it does.

This booklet contains a few tools to help you put Conservation into your classroom. It is not designed for a particular grade level, but for intermediate children in general. We hope that you will find the activities interesting and that the results will be profitable.

1. Experiment: How important is water to you.

Objective: Conclude through written or oral expression the importance of water to all living things.

Water is needed by living things in order for them to carry on the complex activities of life. Most tissues of organisms are made of 70-95% water. Even the driest seeds are made of 4% water. Even bread which feels dry has water in it.

The chart below gives some facts already known. Students should select their own items for observation and classification.

WATER CONTENT OF VARIOUS ORGANISMS

ORGANISM	PERCENT WATER
ANIMALS:	
Jellyfish	98
Cabbage Worm	83
Chicken	56
PLANTS:	
Watermelon	95
Maple Leaf	85
Barrel Cactus	65

Following are some suggestions as to how the experiment may be conducted:

a. Ask students if they know how much water bread loses when it is toasted. Then have them weigh a piece of fresh bread on a scale. Record the weight of each piece. A chart similar to the one below could be used.

ORGANISM	WEIGHT BEFORE WATER LOSS	WEIGHT AFTER WATER LOSS	TOTAL WATER LOSS

b. Put the slices of bread into a toaster and toast them. The heat will cause water in the bread to evaporate. If a toaster is not available, the bread can be placed in direct sunlight until the water has evaporated.

c. Select different organisms such as apples, oranges, leaves, celery, lettuce, tomatoes, radishes.

d. Allow the students to form hypotheses concerning which organisms contain the most water and tell why they think this.

e. They can test their hypotheses by performing the experiment and recording their information.

2. Experiment: Algae experiment.

Objective: Students should be able to set up experiments, record results, formulate hypotheses, and draw conclusions about the effects of pollution on algae and other plant and animal life in our waterways.

Algae can be obtained from your classroom aquarium if you have one, or have students bring in water from ponds that contain algae. There are always students who enjoy the extra activities.

Set up two dishes of water containing algae. Place one in the shade and one in the sun. Have the children observe whether or not algae grows better in the sun or shade.

Place the algae water in six (6) more dishes. Place various pollutants such as oil, detergent, and sulphuric acid (a waste that forms from coal-mining operations) into the water. Two dishes should contain oil, two with detergent, and two with sulphuric acid (or any other pollutant). Again place three dishes in the shade and three in the sun. Be sure they are labeled properly. Students should make a chart to record their observations of algae grown under different conditions.

Have students state hypotheses about the end results. Which pollutants are most harmful to plants. Will algae continue to grow if shaded? The teacher should make students aware of the importance of algae as a possible source of food.

Photosynthesis can be studied along with these experiments in order to understand the importance of sunlight.

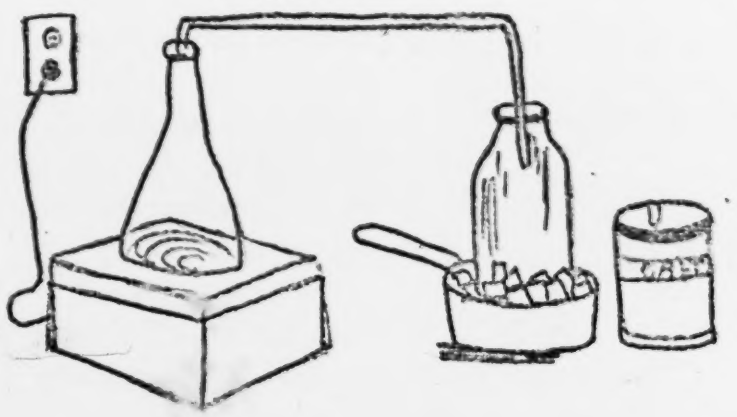
Questions: What happens when detergents are added to the algae? Did the growth continue or did it stop? Why do you suppose this occurred? Would this condition be harmful to animals in the stream? Why?

Teacher Notes: Detergents, especially those that can't be broken down biologically cause foaming in waterways. These foams kill aquatic animals by clogging their gills, preventing them from obtaining dissolved oxygen. Also detergents contain phosphates. Phosphates are an essential nutrient for the growth of plants and are often used in plant fertilizers. In a stream, phosphates in detergents stimulate the growth of algae and aquatic plants in the same manner as phosphates in fertilizer.

3. Experiment: Distilling salt water.

Objective: Making fresh water from salt water.

Materials: flask and one-hole stopper that fits the flask and a bent tube to fit the stopper.
bottle or jar
ice cubes
pan
salt
watch
water



Stir salt into a cup of water until no more salt will dissolve. Taste the salt water, but do not drink it. Pour the salt water into the flask and set the flask on the hot plate. Insert one end of the glass tube into the stopper and place the stopper in the flask. Put the other end of the tube in the bottle.
CAUTION: Do this only under the direction of the teacher.

Adjust the electricity so that the salt water will boil gently. Observe what happens.

Questions: How long does it take for the water in the flask to evaporate? What is in the bottle? Taste it. Measure it. Where is the salt?

Teacher Notes: This method of purifying water is called distillation. Distillation produces water that is almost pure. However, the cost of distilling ocean water is an expensive process. This conclusion may be left for the students, after explaining what the process is called.

4. Objective: Identify the trees on your school yard and/or other nearby area by studying one individual tree.

Adopt a tree on your schoolyard or other nearby area--find out what kind of tree you have adopted.

a. Start a scrapbook, called "MY ADOPTED TREE," and include a sketch of your tree in each season; a sketch of its winter buds, flowers, fruit, and seeds; a pressed leaf taken in spring, summer, and in the fall. See how the leaves change from season to season.

b. Find our what animals use your tree for their home. Look for beetles, tree frogs, spiders, katydids. Look for rival ant colonies around the tree trunk, and for squirrels hiding places for nuts or acorns in of the trunk or branches.

c. See what animals or plants live on the ground under your tree. Record your findings in your scrapbook.

d. Turn over a log or rock to find what lives under it. Be sure to put it back in place carefully so as not to destroy the homes of any tiny creatures.

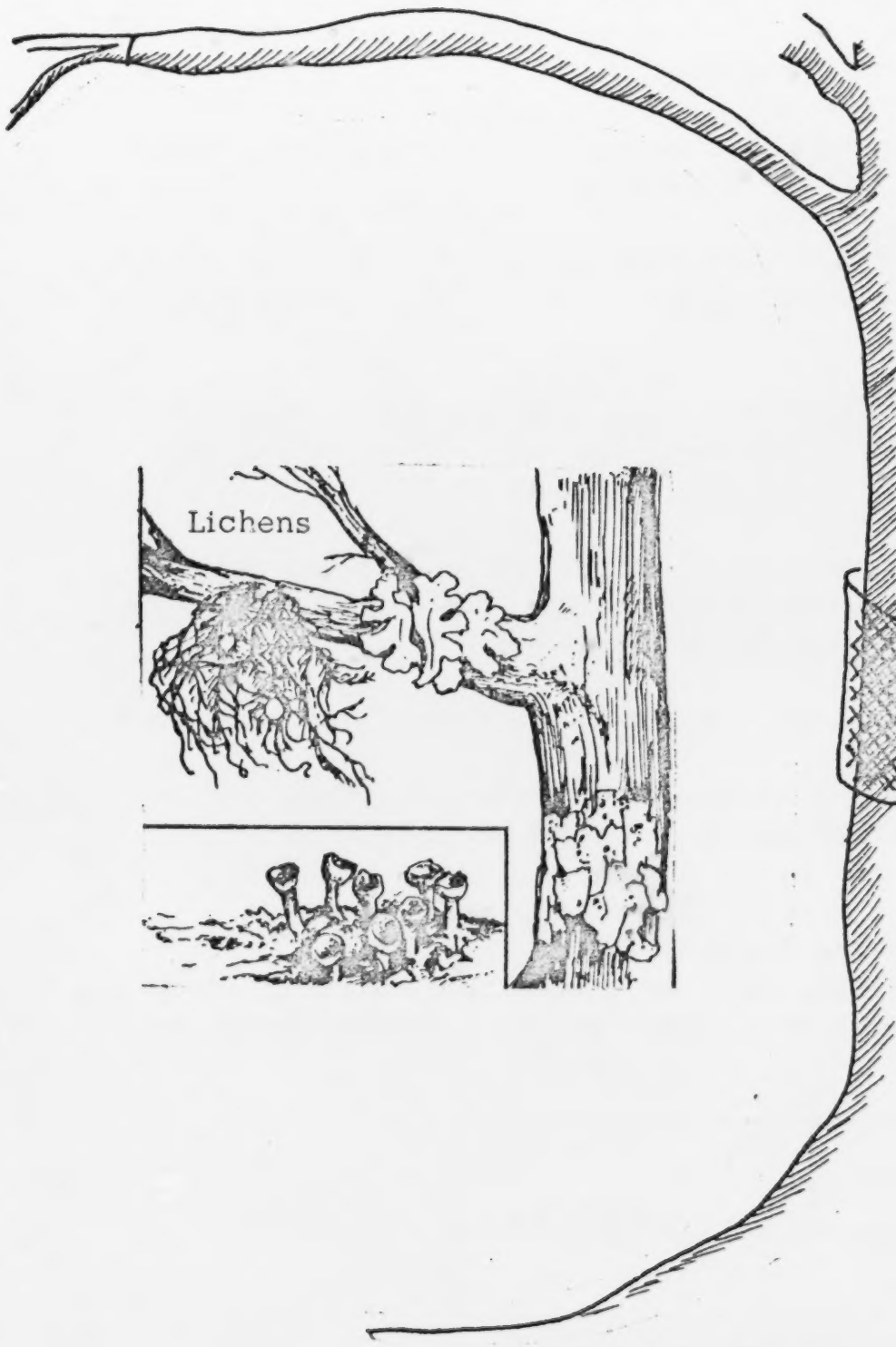
e. Watch your tree on a rainy day. See how the leaves break the force of the raindrops. They keep the drops from hitting the ground too hard and washing away valuable soil.

f. Watch the clouds over your tree. Find our how to tell the difference between rain and "fair weather" clouds. You may be able to foretell the weather by knowing them.

g. Record data about your tree. Some of the things you might look for are:
- the date the first leaves change their color.
- any animal or bird that makes its home in your tree.
- the height of your tree in the spring and again in the fall.
- the diameter of your tree in the various seasons.
- the time that the leaves begin to fall.
- any visitor to your tree, such as a squirrel, raccoon, bird, etc.
- plants growing on your tree, such as vines, moss, fungi, or lichens.

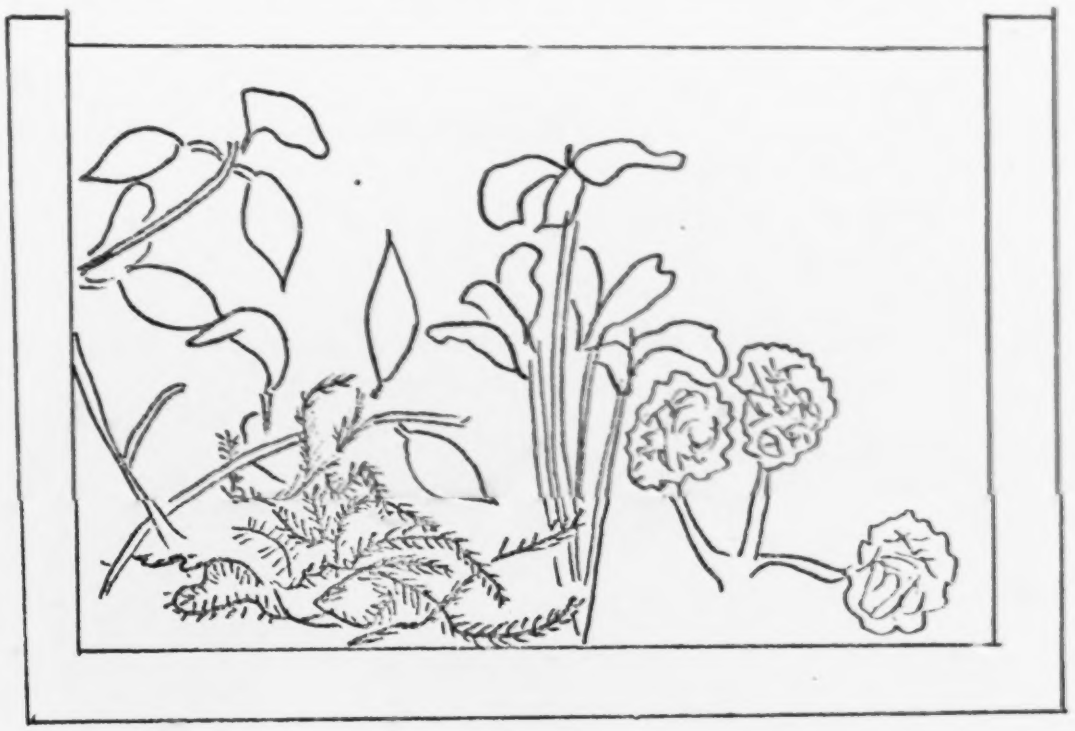
FALL	WINTER
SPRING	SUMMER

Winter



5. Objective: Show that soil contains seeds, plants, and insects.

Dig up a square foot of earth, about six inches deep and bring it indoors. Put in an old aquarium or other container with a screen on top. Keep it warm and moist and in a light place. Watch for tiny plants that will start to grow from seeds buried in the soil. Watch for tiny creatures moving about.



6. Objective: Describe, distinguish and identify materials and insects found in a square foot of soil.

Dig up another square foot of soil about six inches deep. Bring indoors and spread it on a big sheet of wrapping paper and count all the creatures. You could make a table similar to the one below:

Earthworms	6
Centipedes	4
Millipedes	19
Ants	28
Sowbugs	12
Spiders	1
Beetles	29
Unidentified	30
Total	129

7. Objective: Describe observable properties of your schoolyard by making a map.

Make a map of your schoolyard. With a crayon, sketch each tree and label. Sketch landforms and any other observable physical properties.

8. Experiment: Woodland Terrarium--The terrarium is another means of examining life in captivity. Small plants and mosses can be grown. If a small dish of water is kept in the terrarium it will be possible to keep tiny tree frogs and toads. Large amphibians cannot be kept due to lack of oxygen and the larger frogs and toads dig into the soil and destroy plant life.

Objective: Construct a terrarium from materials found on the schoolyard or in a woodland.

Materials: Any jar with a lid (gallon size is nice, but smaller jars will be suitable.)
gravel
charcoal
soil
small plants such as violets, mosses, ferns, begonias, coleus and any shade loving plant.

A terrarium can be made from almost any glass jar or bottle as long as it is reasonably airtight. If you can't find a lid, plastic wrap can be used for a cover.

Line the bottom of the container with a layer of pebbles, for drainage and a little bit of charcoal to sweeten the soil. Next, put a layer of leaf mold or other rich soil for the plants to grow in. Any plant that will not grow larger than the container is all right to use.

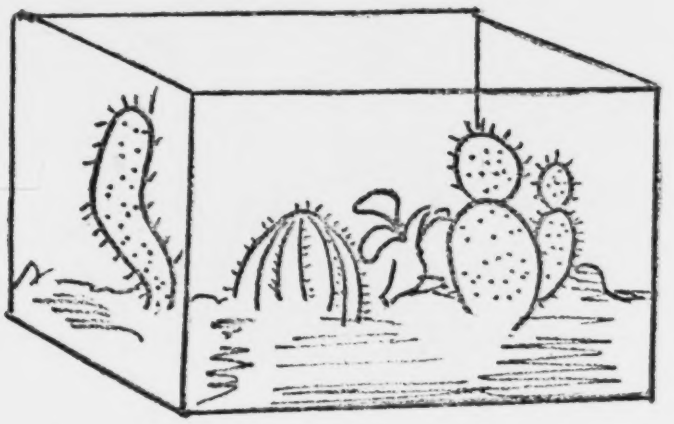
Insert the plants with the help of a spoon, wooden stick, or finger and tamp down the soil. Fit small pieces of moss to hold the plants in place and to give the terrarium a finished look.

Your terrarium should need little or no care. If it becomes too wet, put a very small hole in the lid to allow the air to circulate. It if becomes too dry, water very lightly.

Be sure to use only the very common woodland plants in your terrarium. Never use any plant that you may think is rare--check with your State Conservation Office if you are in doubt.

9. Experiment: Desert Terrarium--The same procedure can be followed to plant a desert terrarium, except in place of soil, use equal parts of sand and soil over the gravel. Small cacti, jade plants, hens and chickens, will grow well in this environment. After the plants are in place, the soil should be kept moist until roots are established, but never add so much water as to leave pools. After that, water sparingly, perhaps once a week. Small lizards may be kept in the desert terrarium if food such as small insects or worms are provided.

Students may want to experiment with different plants to see under what conditions certain plants will thrive. They might use small pots and plant woodland plants in the sand mixture and place in the sun. Other possibilities are cacti planted in soil and kept in shade. Cacti planted in all sand and kept in the sun and shade. Plants grown in darkness. Students should be able to formulate hypotheses as to the outcomes of the various conditions.



10. Objective: Construct a simple seed classification.

Collect seeds and make a chart for your classroom. Fasten the seeds to posterboard and label them by name or by the way they travel from place to place. (Some examples shown on next page.)

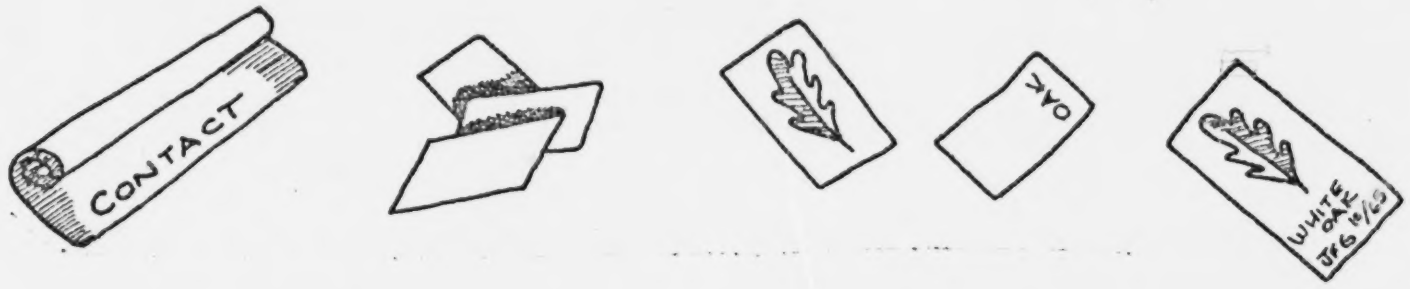
Seeds are important because they are the means by which a plant reproduces itself. It is necessary for a plant to spread its seeds far and wide if it is to do its part in NATURE'S CYCLE.

FLY
Maple
Pine
Milkweed
Dandelion
GLIDE
Ash
RIDE
Burr
Beggar's Ticks

11. Objective: Identify and label leaves.

Collect leaves and lay flat between papers. Take a leaf and put it in the center of the sticky side of contact paper. Next take a 3 x 5 card, (or any size you need) print the name of the leaf, the date collected, and your name on the bottom of it.

Pick up your contact paper, with the leaf on it, turn it over and press it down on the card. This will give you a card with a preserved leaf that is completely labeled. (This method can also be used for preserving insects.)

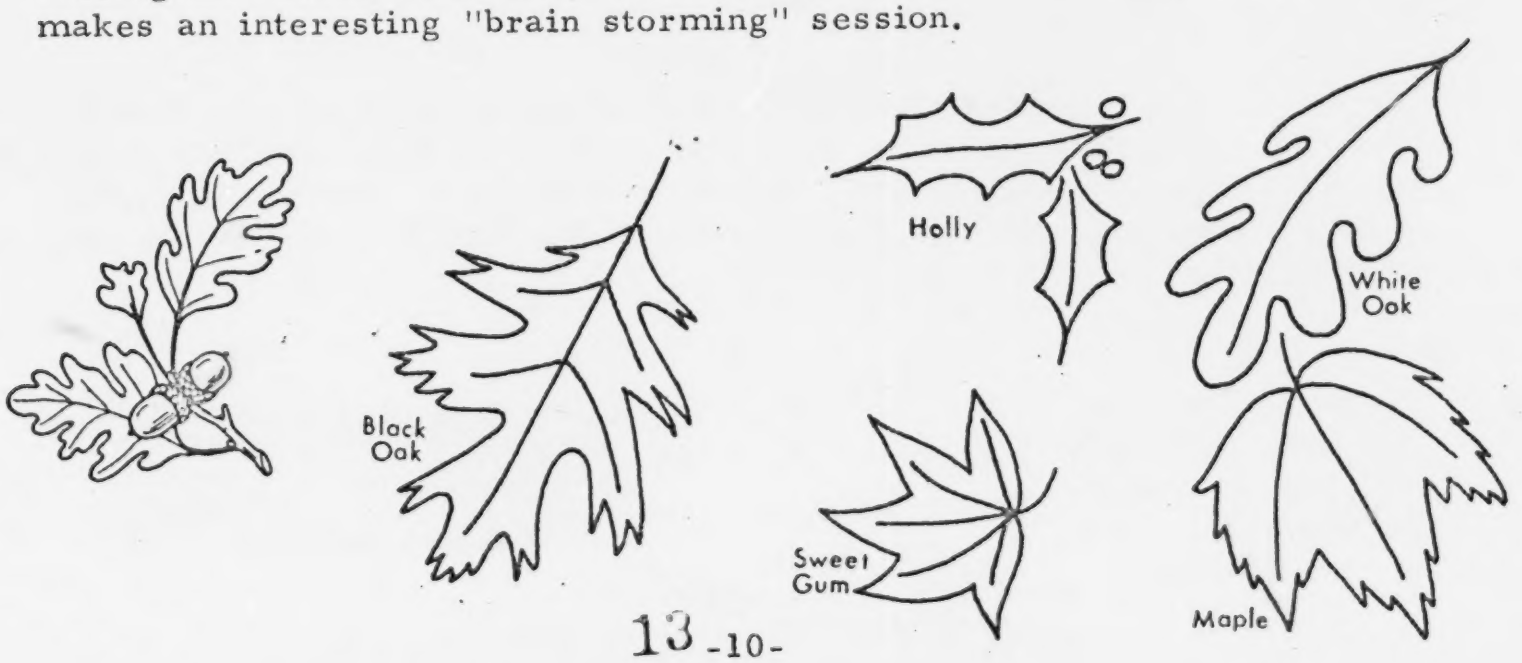


Another technique for preserving leaves and insects is to cover both sides with clear contact paper. This preserves them almost indefinitely. The color will change to some degree but the texture remains the same.

12. Objective: Keeping a record of plants.

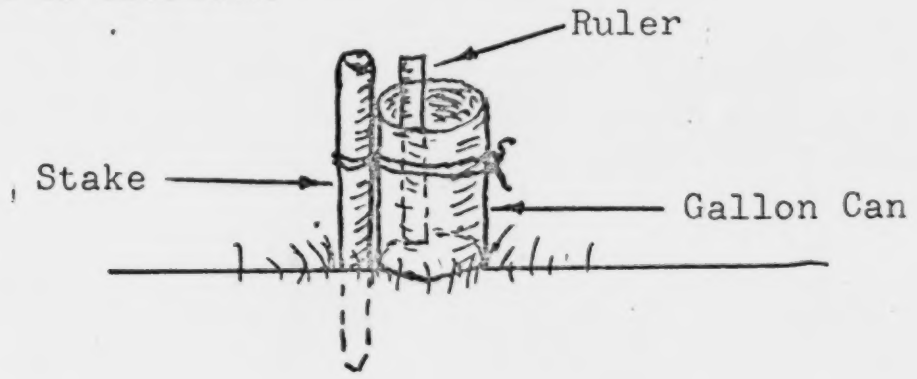
Make a list of plants which you know are dormant in winter. Keep a record to show signs that they have become active again.

You might begin by talking with the children and saying that different kinds of plants have different "time clocks." Their seeds germinate, grow, and produce flowers at different times. When days grow longer in the spring, the buds swell and open and the cycle starts over. What is the "clock" that regulates these activities? Living things seem to possess "biological clocks" that help them to survive in their environment. This makes an interesting "brain storming" session.



13. Objective: Build a simple rain gauge.

Set up a simple rain gauge by using any can with vertical sides. Use a thin metal or plastic ruler to measure water depth. Set the gauge away from buildings, trees, or shrubs. An unused corner of the schoolyard is excellent.



Measure the depth of water or melted snow and empty the can after each storm. Keep a record of each storm. After the record is completed, figure how many gallons of water fell on your schoolyard.

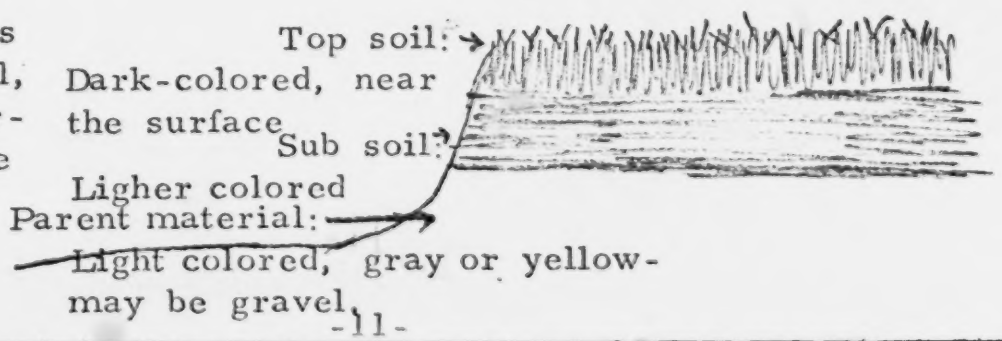
One formula which can be used is by taking the total schoolyard area (in square feet) times the total depth of rainfall (in feet) times $7\frac{1}{2}$ gallons per cubic foot equals the approximate number of gallons of water which fell in your school.

14. Objective: Demonstrate a way of showing that plants produce greater growth in top soil.

Line two boxes with foil or heavy wax paper. Place top soil in one and parent material in another. Smooth out each sample and water it enough to keep the soil moist, but not wet. Keep the boxes near a window for several days. Do you see any plants starting to grow? Do the results show there is life in the top soil and there is no life in the parent material?

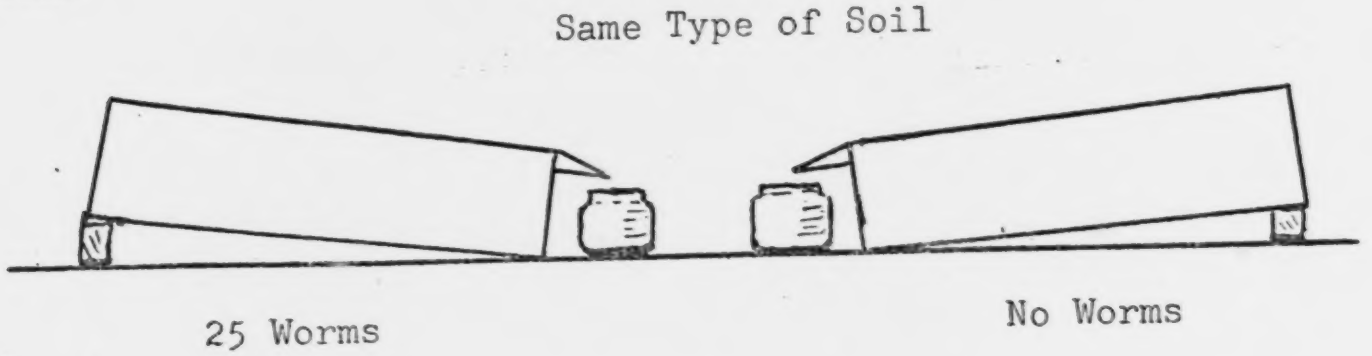
After three weeks, remove all the plants growing in both boxes. Stir the soil and plant wheat or grass seed in each box. Then again, keep both boxes warm, moist, and near a window. Keep the plants growing until you can see a difference in the health of the wheat or grass in the boxes.

These three parts top soil, sub soil, and parent material together make a "soil profile."



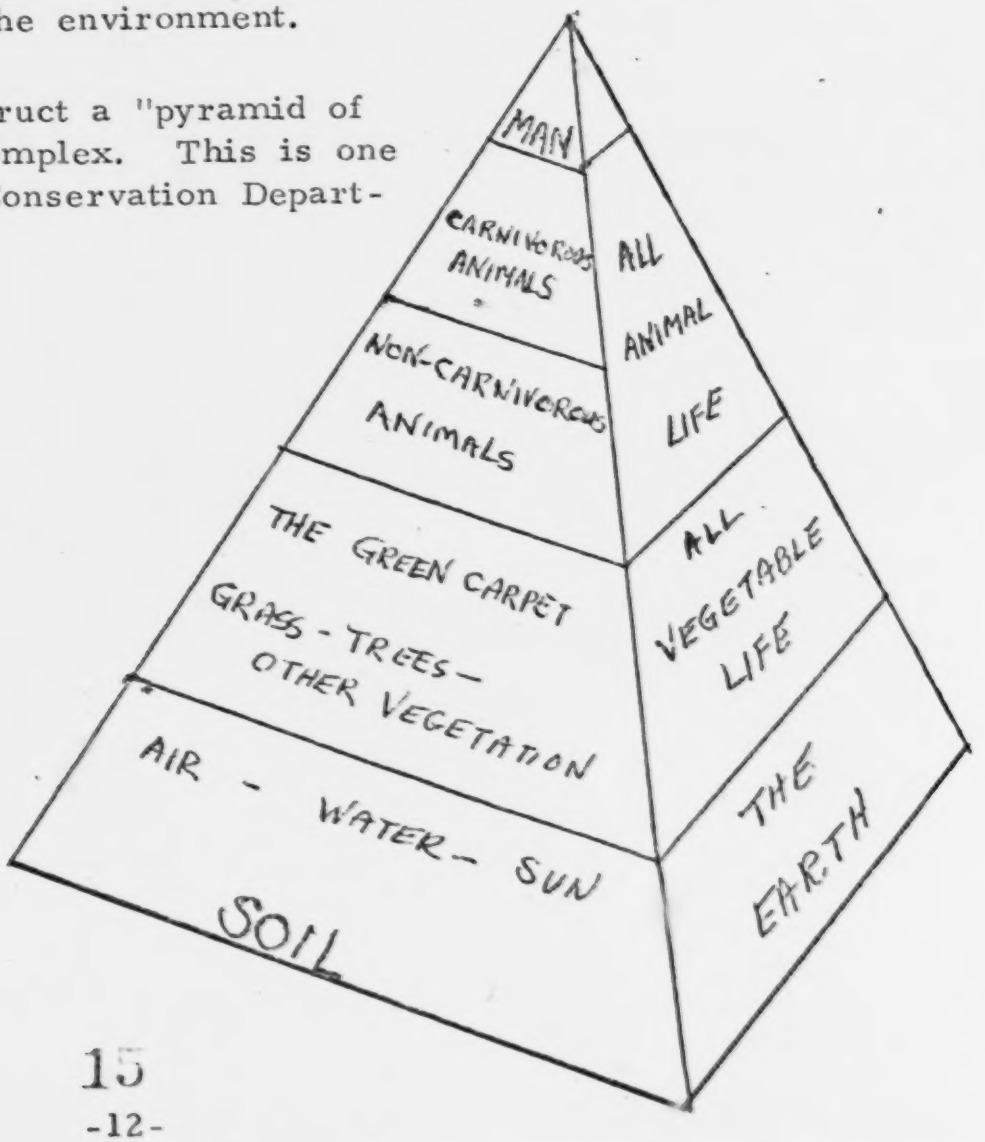
15. Objective: Construct an experiment to demonstrate that earthworms are beneficial to the soil.

Fill two boxes with the same amount and the same kind of soil. Place twenty five (25) full grown earthworms in one box. The second box contains no earthworms. In about a month, pour equal amounts of water containing food coloring in both boxes. Notice that the water poured in the worm filled box seeps into the soil, because of the earthworm passages. If plants were growing in this soil, they would be nourished more than if they were growing in the soil which contained no earthworms. Insects which live and die in the ground also enrich the soil.



16. Objective: Construct a simple classification system to show man's dependence on the environment.

With your students, construct a "pyramid of life." It can be simple or complex. This is one constructed by the Missouri Conservation Department.



17. Objective: Build a diagram with string and cards illustrating a web of life.

One of the fundamental ideas of conservation deals with the inter-relationships between animals, animals and plants, and plants themselves. This concept is too little understood, yet it is essential if one is to manage resources wisely. Here is a simple diagram that children might build.

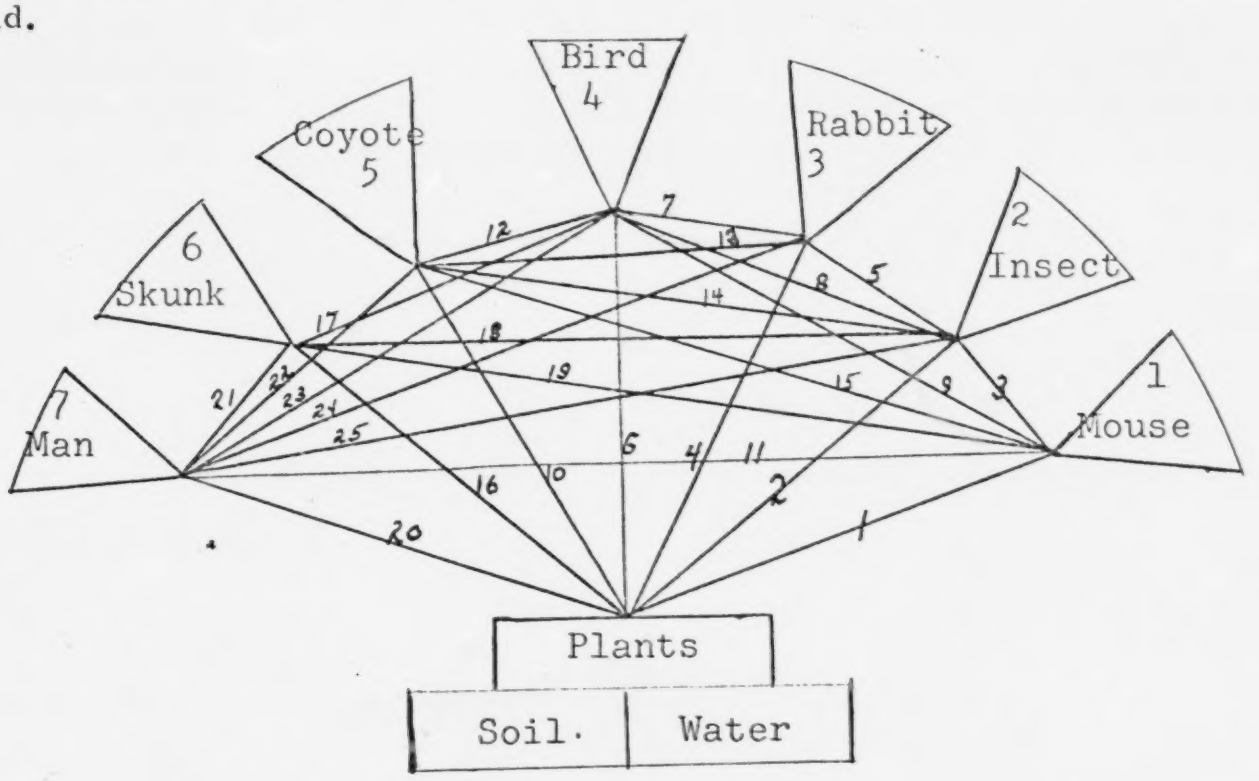
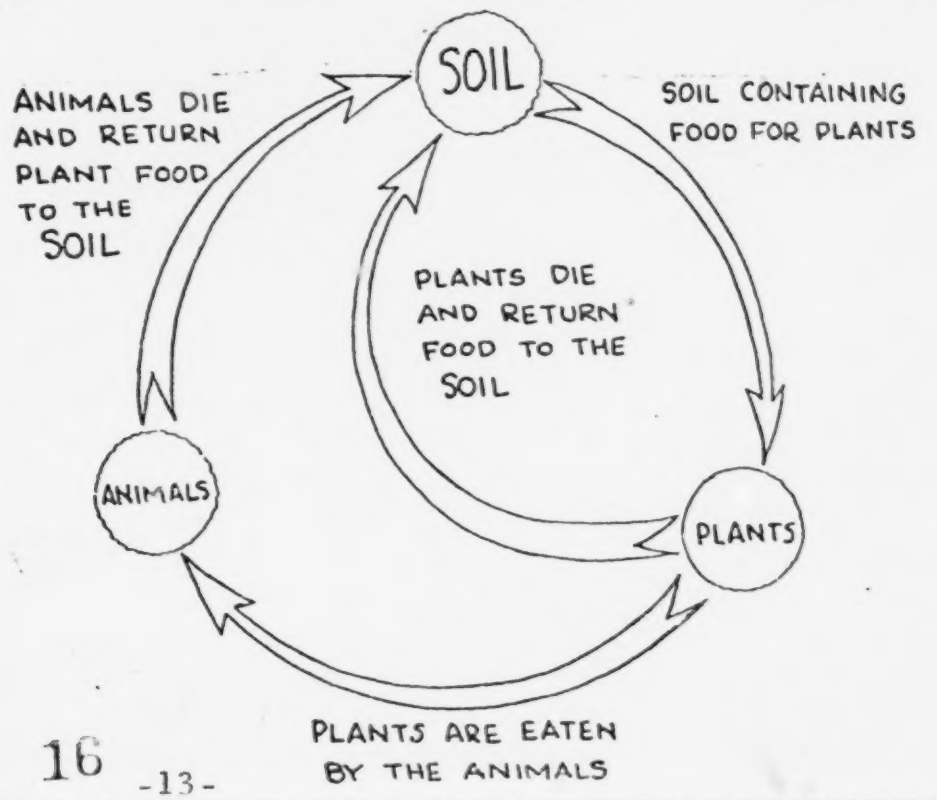


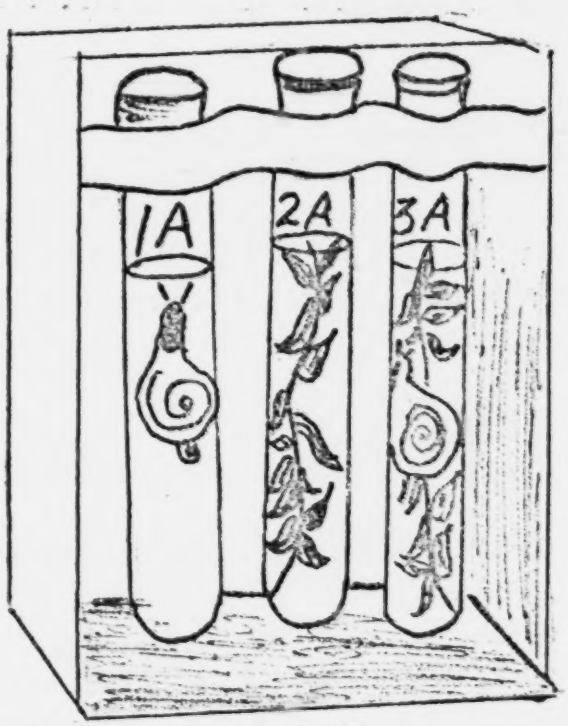
Diagram of the Story
(Numbers on cards and strings designate sequence in which used)

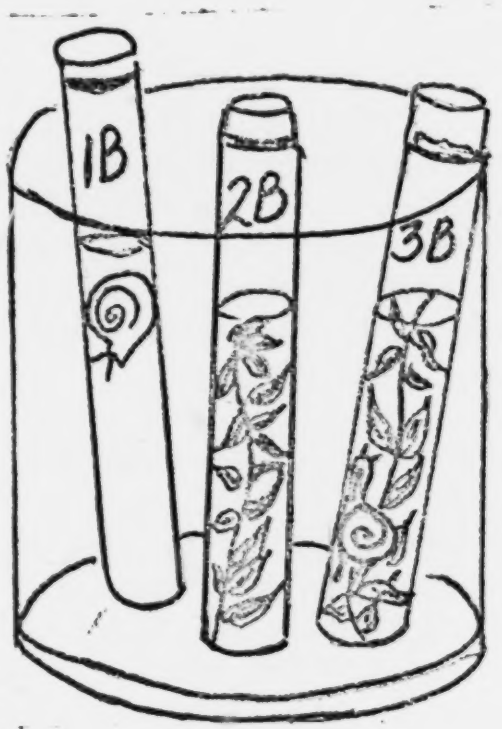
18. Objective: Student should be able to state orally or write how animals and plants depend on each other for survival. (See diagram)


SOIL
SOIL CONTAINING FOOD FOR PLANTS
PLANTS
PLANTS ARE EATEN BY THE ANIMALS
ANIMALS
ANIMALS DIE AND RETURN PLANT FOOD TO THE SOIL
PLANTS DIE AND RETURN FOOD TO THE SOIL

Experiment with snails and Elodea:

What happens when a snail and a stalk of Elodea are each placed alone in a sealed test tube containing water? What happens when a snail and a stalk of Elodea are placed together in a sealed test tube containing water?





Materials: (available through consultant)

- quart jar
- six test tubes with cork or rubber stoppers
- three snails of the same kind
- three stalks of Elodea
- paraffin
- a box or can

Fill the quart jar with tap water and let it stand for 24 hours with the lid off. Fill each of the six test tubes two-thirds full of water from the quart jar. Divide the test tubes into three pairs. Add one snail to each test tube of the first pair. Label each test tube of this pair with a numeral 1.

Place a single stalk of Elodea into each test tube of the second pair. Label each test tube of this pair with a numeral 2.

Add one stalk of Elodea and one snail to each test tube of the third pair and label each test tube of this pair with the numeral 3.

Place the cork or rubber stopper in each test tube. Melt some paraffin and dip the top part of each test tube into the melted paraffin so that it is sealed tightly.

Take one test tube from each pair. Label each of these three with the letter A. Place the A set in a box or can and cover it to prevent light from entering.

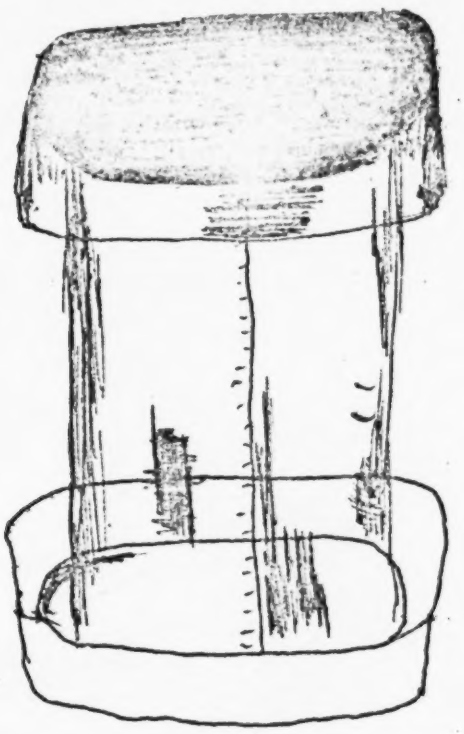
Label the other three test tubes with the letter B. Place these where they will receive sunlight. Try to keep the temperature of both sets the same.

Observe the two sets of test tubes each day. Keep a daily record of the changes that are observed in any of the test tubes. Decide what headings could be used for the record. In which test tubes is the greatest change observed? How do light and darkness affect the snails and Elodea? Have the students compare records with those of their classmates. Do snails and Elodea live longer when they are together or when they are separated? Why?

19. Objective: Demonstrate the proper care of insects in the classroom.

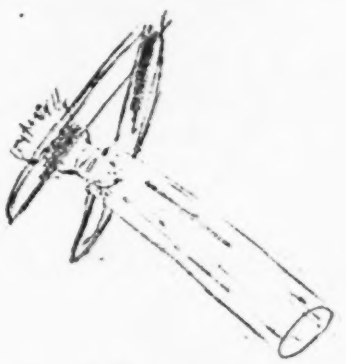
Build an insect zoo. In the fall and early spring, it is fun to watch insects grow and develop. A cage can be made from a plastic box, a jar, a flower pot, lamp chimney, or other container. Fill the bottom with soil. Top this with grass sod. Insert a twig or small branch in the grass for the insect to climb on. Every once in a while sprinkle the cage with water to keep the grass growing. REMEMBER - Insects are living things. Keep the cage clean and feed and water them every day.

Materials: plaster of paris
two aluminum tins three inches deep. (roaster pans work well)
soil
grass seed
small jar and cotton
wooden supports 12 inches high
screen wire 12 inches high and long enough to fit around the inside of aluminum tin.



Fit the screen into the tin and sew, tie, or pin it together. Thin picture hanging wire can be used easily since it can be cut with scissors. Mix enough plaster of paris to cover one or one and one-half inches of the bottom of the cage. Anchor the screen in pan and pour plaster of paris inside. Add wooden supports before plaster sets. When cast is dry, fill remainder of pan with loose soil.

Plant grass seed to create a natural setting for the insects. Cover the top with remaining aluminum pan. Provide water for insects by using a piece of cotton inserted in the top of a small bottle that contains water. Trim cotton of loose fibers. Turn the bottle on its side. Sprinkle inside of cage lightly each day.



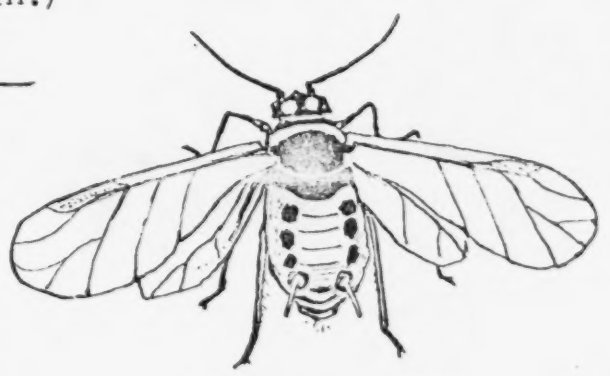
Students can collect a variety of insects and spiders to keep alive inside the cage. Cocoons and chrysalises can be added and observed from fall until early spring. NOTE: Praying Mantises' cocoons can be found from late fall until early spring. If these are kept until spring, they must be put outside during the winter to prevent premature hatching. Freezing will not hurt the cocoon.

Students will be able to observe a complete life cycle of several moths and butterflies. The monarch can be observed in the fall when it is in the caterpillar stage. After the caterpillar has spun its chrysalis students can observe the various changes that take place before the monarch emerges. At this time it would be interesting to read the book The Travels of Monarch X and chart a course of travel according to the story.

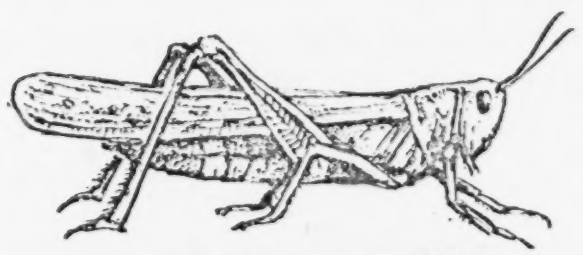
LAND INSECTS

Aphid (to $\frac{1}{10}$ in.)

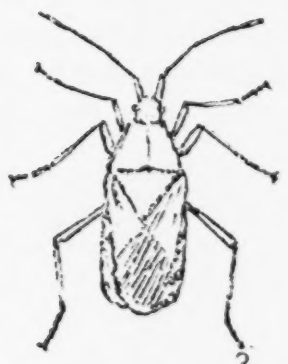
wingless female



winged female



Grasshopper (2 in.)

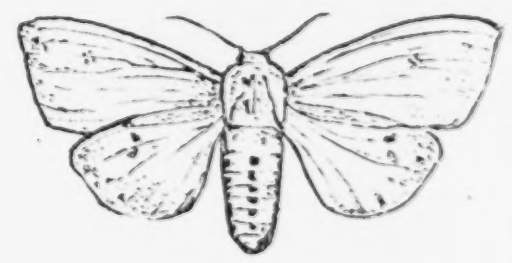


Squash Bug ($\frac{3}{4}$ in.)

Cricket (1 in.)

(to 1 in.)

(to 2 in.)



(2 in. wingspan)

Monarch Butterfly

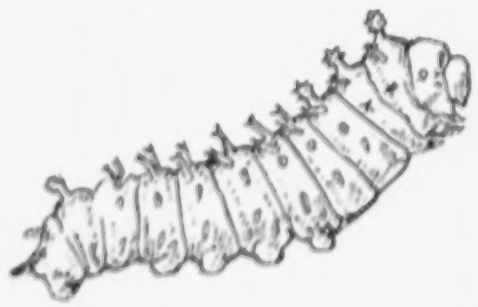
($\frac{1}{16}$ in.)

(to 2 in.)

(to $1\frac{1}{4}$ in.)

(4 in. wingspan)

Cecropia Moth



(to 4 in.)

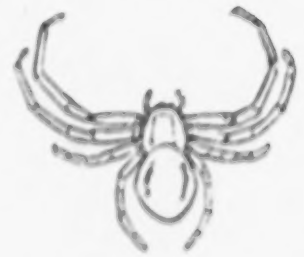
(to $1\frac{1}{4}$ in.)

($5\frac{1}{2}$ in. wingspan)

Harvestman
(Daddy Longlegs)

Garden Spider

Tarantula



Crab Spider

Hopefully, the students will discover many interesting facts about life in their insect cage. For example, when cocoons hatch it is interesting to get books for identification of the moths. Also, the female moth will lay her eggs and die very shortly after hatching in the spring. It may be more exciting for children to discover for themselves that the praying mantis cocoon will hatch during the late fall if left inside. The babies are harmless and very interesting to examine under a hand lens.

Crickets will eat bread soaked in water, corn mush, bits of lettuce, and once in a while peanut butter. The grasshoppers will eat the grass in the cage, so be sure it grows well. If you should buy some silkworms, remember they require a very special diet of fresh mulberry leaves. Wooly bear caterpillars will eat the grass and any clover that might be growing in the cage.

Most other insects can be fed the plant on which you find them, except for the praying mantis, chick beetles, and the lady bird beetle. These eat other insects and need a special diet.

20. Objective: Students should be able to identify insects chosen for encasing in plastic.

Materials: Valspar clear casting resin
molds of various sizes (any flexible plastic container can be used if it is not too deep.)
insects and spiders collected by students

Mix the resin according to the directions on the can. NOTE: Mix only enough resin to cover the bottom of molds. The more hardener used, the slower the drying time. It is desireable to have the molds dry slowly to avoid ripples in the finished product.

Place the insect on its back in the bottom of the mold. Pour approximately one-half inch of resin into the bottom of mold. The insect should be covered only enough to secure it in the bottom of the mold (one-fourth inch liquid may be enough).

Using a toothpick, position the insects body and legs for best display. Allow to dry for about 45 minutes. Mix enough resin and fill mold to desired depth. Allow to dry for several days if possible. The directions on the can states that your mold will be dry overnight. It will dry in this period of time, but fingerprints are easily left which can ruin the appearance of your display.

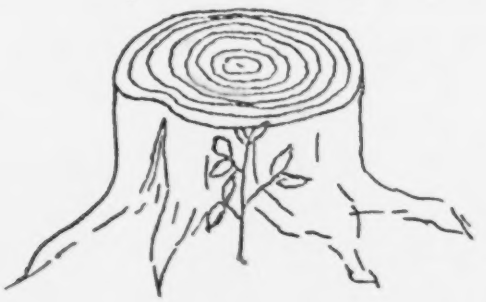
When completely dry, remove the mold as you would an ice cube. The bottom may be covered with felt to enhance the appearance of the insect. Use white felt for dark specimens and dark colors such as red or green for lighter insects, such as white spiders.

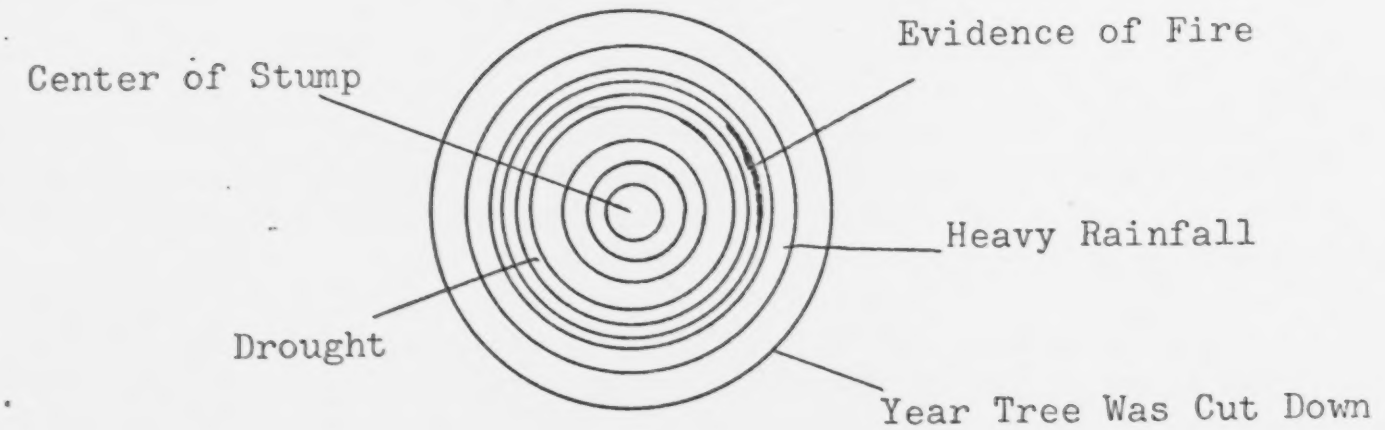
Any scratch that is on the surface of the mold will show in the finished product. These can be almost erased by applying two coats of self-polishing floor wax after the encased object is completely dry.

Owl pellets (small objects found on the ground that look like a bird's nest) contain bones and skulls of animals which the owl has not digested. These make interesting molds, especially the small skull of a rodent or bird which can be the source of much research.

21. Objective: Trace the history of an area by studying a tree stump.

"STUMPING THROUGH HISTORY"





If you can find an area where a tree stump is standing, it can be used for history, social studies, and conservation. Here are some suggested uses for a stump:

a. Discuss the area surrounding the stump.

b. Sketch the area and take mathematical readings to reconstruct the stump and area.

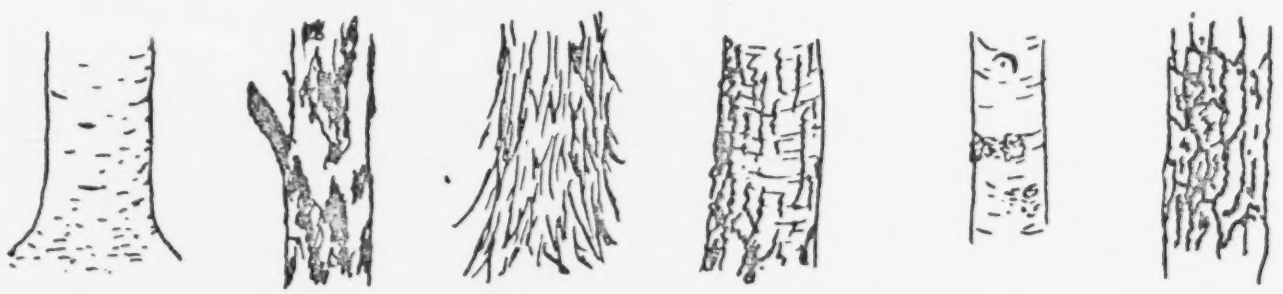
c. Trace the history of the area, age at the time the tree was cut down, date of cutting, dates of historical happenings within the area, etc.

d. Studies may be made of all factors affecting the growth of the tree--water, fire, weather, man's living habits, and effects of animals in the area.

e. Let each student take a different ring or different event and show how the rings and events are interrelated and how man is dependent upon his environment.

Probably many other ideas will come to mind as you work with the stump. Students should become aware of how happenings in nature effect their surroundings.

22. Objective: Demonstrate the differences in the texture of the bark of trees by taking paper or cloth rubbings.



Take a "Bark Hike." Notice the varying patterns and colors of the bark of different species. Make drawings of bark from various trees by rubbing crayon or chalk over a piece of fine paper or cloth placed on top of the bark.

Barks of most trees are rough-textured because they split their bark. This outer covering protects the thin cambrium layer through which the food tubes carry nutrients down from the leaves where plant food is manufactured through the help of sun and water.

23. Objective: Identify six common animal tracks in the snow or soft earth.

In the winter when the snow falls is a very good time to follow the tracks of animals. The size, shape, and clearness of any track depend on the snow or ground conditions. Muddy places, along streams and along natural runways is also good for tracks.

When looking at tracks note their size and shape, the number of toes and the pattern of the tracks. Look at the tracks and see if they tell a story, such as an animal feeding, an animal meeting another animal, a bird taking off into the air, a fight between two animals, etc.

HOUSE CAT

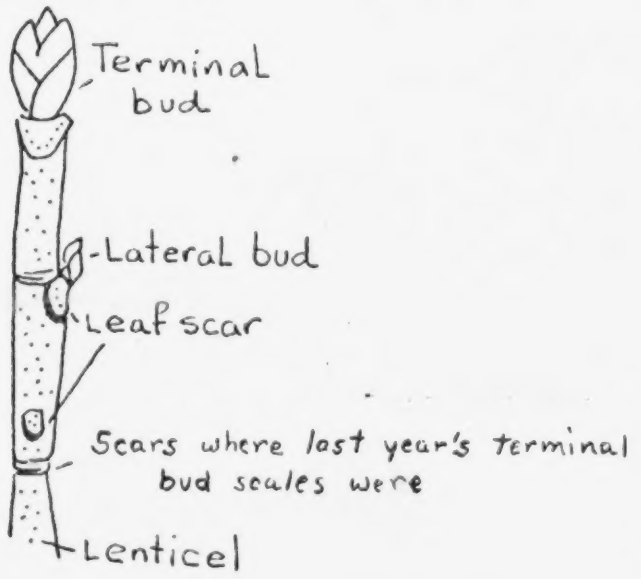
SQUIRREL

DOG

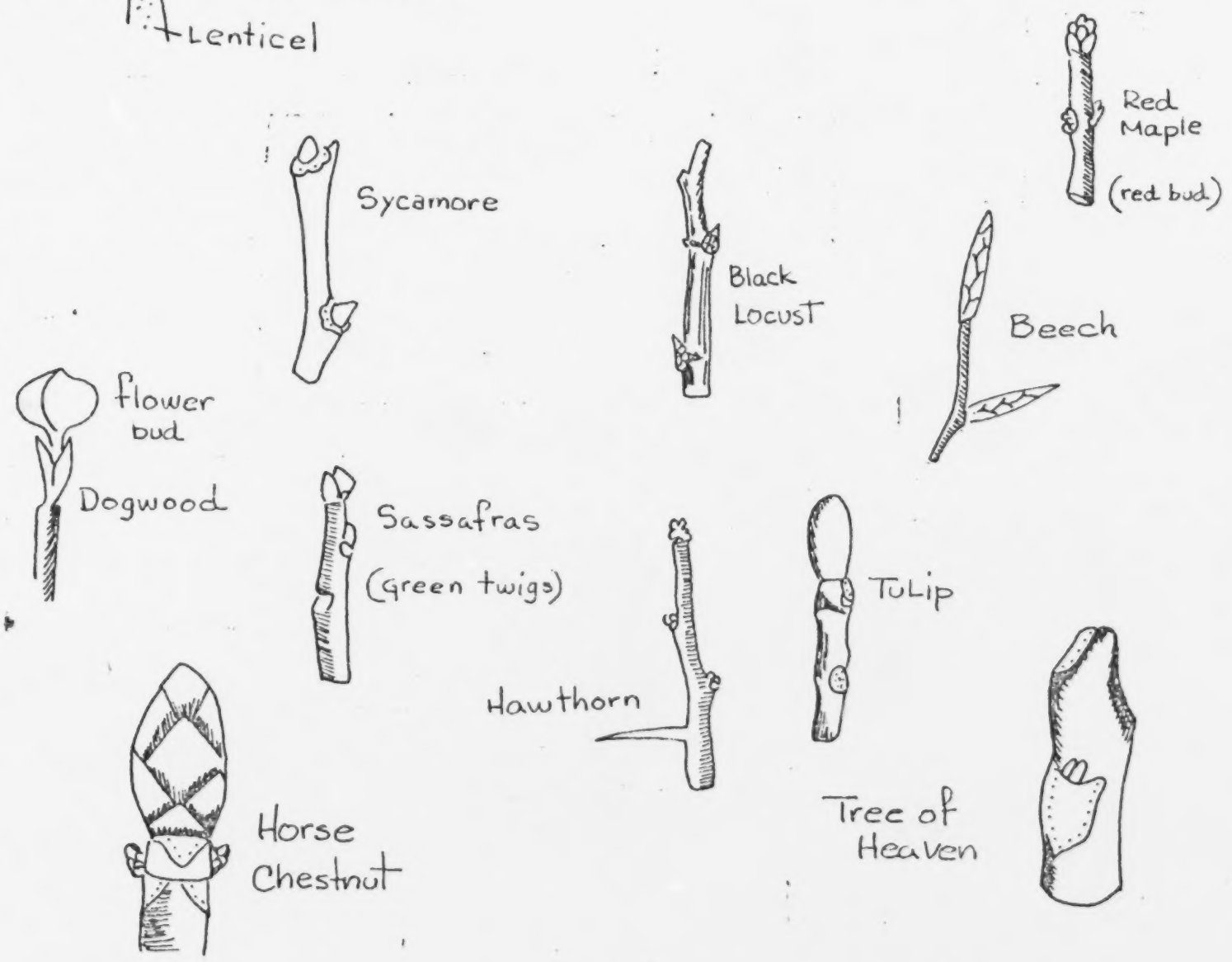
RACCOON

24. Objective: Identify the parts of a winter twig.

During the summer growing season, a bud is formed at the end of most twigs. This bud is called a terminal bud. Buds are also formed above each leaf. When the leaf falls from the twig, it leaves a scar, above which buds have formed. These buds grow into new stems with leaves or flowers. The leaf buds along the sides of the twig are called lateral buds.



Examine a bud carefully with a hand lens. On some kinds of plants the buds have overlapping scales, instead of the waxy covering. The scales can be brown, red, or green and are designed to protect the buds from the winter wind and loss of water. The leaf scars are places where last year's leaves have detached. Lenticels are the tiny "holes" where air passes in and out of the tree.



KEYS
An Aid to Biological Identification

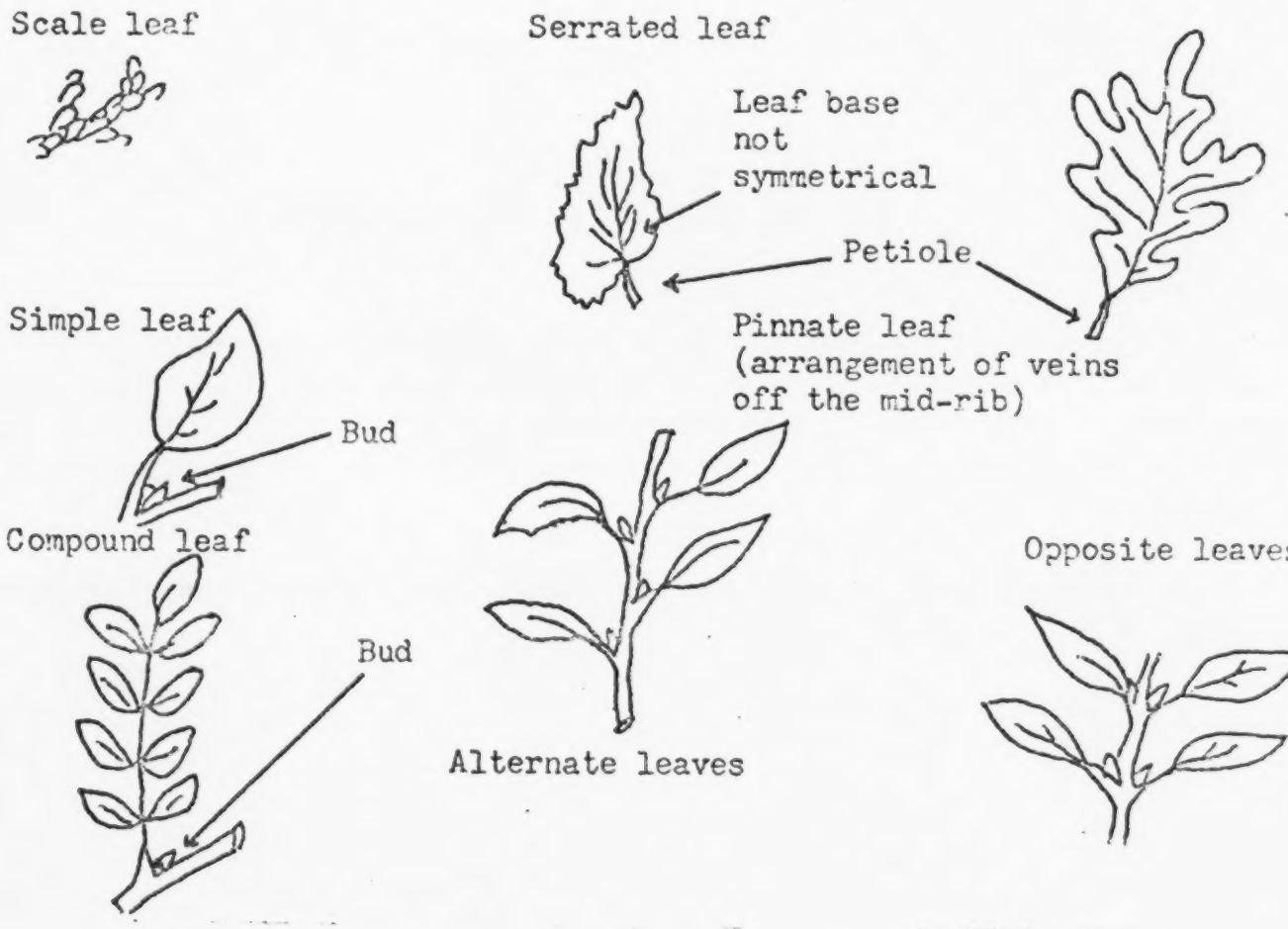
Keys are important for they help children to observe plants and animals closely and see how they are similar and different from one another. Keys enable students and teacher to identify groups of plants and animals and see some of the organizational patterns used by scientists.

Following is a simple key for eight trees taken from SCIENCE AND CHILDREN, October, 1964.

A SIMPLE KEY FOR EIGHT TREES

This key can be used for Oak, Maple, Elm, Ash, Cedar, Pine, Hemlock, and Spruce trees. (You can modify this key for the trees around your school.)

Terms used in the key:



KEY

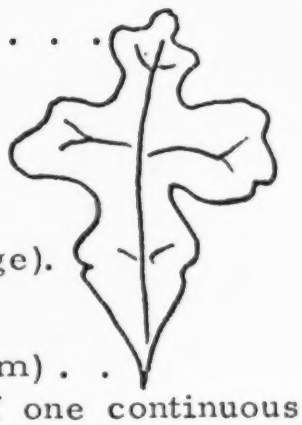
1.	Evergreen trees, leaves, scale-like or needle-like (2)	
1.	Broad leaves, lost in fall of the year (5)	
2.	Leaves needle-like, 2-5 needles in a bundle	PINE
2.	Leaves not in bundles (3)	
3.	Leaves scale-like	CEDAR
	Leaves not scale-like (4)	
4.	Short, stiff leaf, 4 sided leaf, found on all sides of the twig	SPRUCE
4.	Short leaves, flat and blunt at the free end	HEMLOCK
5.	Simple leaf (6)	
5.	Compound leaf	ASH

6.	Leaves arranged opposite on the twig	MAPLE
6.	Leaves arranged alternately on twig (7)	
7.	Leaf pinnate and deeply notched or lobed	OAK
7.	Leaf not lobed, serrated (jagged) edge, leaf base near petiole not symmetrical	ELM

SCIENCE AND CHILDREN
October, 1964

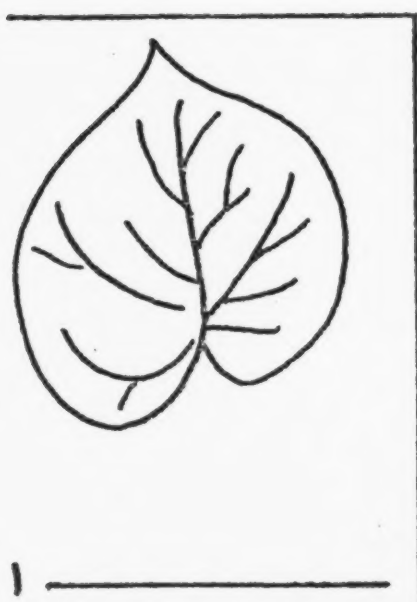
USING A KEY TEST

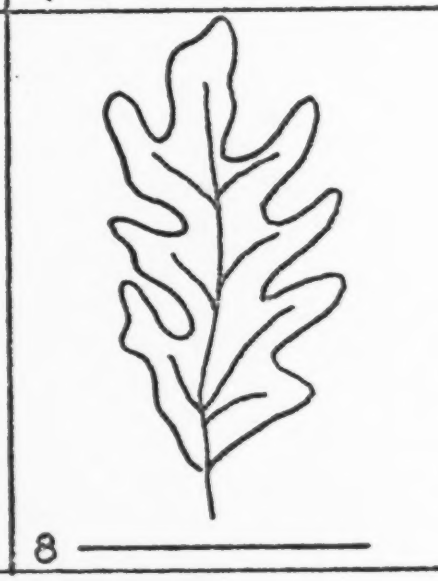
GLOSSARY



Simple: leaf made up of one continuous surface.

Compound: single leaf made up of several smaller leaves (leaflets)





1A	Simple leaves	2
1B	Compound leaves	6
2A	Leaves have lobes	3
2B	Leaves do not have lobes	4
3A	Lobes are rounded	White Oak
3B	Lobes are pointed	Red Oak

4A	Leaf margins are smooth	5 Elm
4B	Leaf margins are rough	
5A	Leaf is wider at base than at apex	Red Bud
5B	Leaf is the same width at the base as at the apex	Dogwood
6A	Many leaflets arranged like a feather (Pinnate)	7 Hickory
6B	Leaflets are few (less than 9)	
7A	20 to 30 small leaflets; tree has thorns	Honey Locust
7B	10 to 20 leaflets	Black Locust

INSECT KEY

In the late spring and early fall, it is possible to set up keys for common insects with a minimum of terminology for the upper elementary grades. You will note that the following key is arranged a bit differently than the tree key. In this key, the two parts of a couplet are indicated by letters rather than numbers and the two parts of the couplet are separated. As in the tree key, the letter in parentheses indicates the next letter that you go to. The two parts of the couplet give you a definite decision to make. For A, it is to determine wings or lack of wings on the insect.

The annotated list of keys and charts given at the end of the article will help in the identification of some plants and animals. The list is not complete, but gives a few of the elementary, intermediate, and advanced keys available. The advanced keys listed are difficult and most teachers will have a hard time with them unless they have taken advanced courses in the field.

Through the knowledge of the use of keys, children will learn how to make careful observations, logical decisions, and see the differences and similarities of living things.

SCIENCE AND CHILDREN
October, 1964

A KEY TO EIGHT COMMON ORDERS OF ADULT INSECTS

This Key can be used for Isoptera, Hymenoptera, Diptera, Orthoptera, Odonata, Coleoptera, Hemiptera, and Lepidoptera insects.

Insect Characteristics: Three pairs of jointed legs, three main body parts, no wings, or one pair, or two pairs of wings.

A. Insects without wings or one pair of wings (B)

B. Insects with one wing pair (other pair is vestigial)
. . DIPTERA (Flies, mosquitos)

B. Ants or ant-like insects with no wings except during mating season (C)

C. White insects (grey with two wing pairs when mating) live in wood, thorax and abdomen are not waspwaisted as in ants.
. . ISOPTERA (termites)

C. Red or black insects, abdomen-thorax connection VERY restricted, wings during mating season.
. . HYMENOPTERA (ants)

A. Insects with two pairs of wings (D)

D. Insects with "powder" (scales) on wings.
. . LEPIDOPTERA (moth, butterfly)

D. Wings not covered with "powder" (scales) (E)

E. Both wing pairs entirely membrane-like (F)

F. Large insects with long thin abdomen.
. . ODONATA (dragonfly)

F. Small to large insects with restricted ("wasp waist") thorax to abdomen connection.
. . HYMENOPTERA (bee, wasp, hornet)

E. Outer wings not membrane-like or only outer part is membrane-like (G)

G. Insects with outer wings as hard covers.
. . COLEOPTERA (beetle)

G. Insects without hard outer wing as cover (H)

H. Outer wings thickened near base, remainder membrane-like, mouthparts for sucking, wings fold on back across each other.
. . HEMIPTERA (stink bug)

H. Outer wings leathery, mouth parts for chewing, wings not folded across back.
. . ORTHOPTERA (grasshopper, cricket, cockroach)

SCIENCE AND CHILDREN
October, 1964

INSECT KEY

1a. Wings and three pairs of jointed legs..... 19

1b. No wings or wings too weak or too small to be used for flying..... 2

2a. Two or three long, threadlike projections at end of abdomen..... BRISTELTAIL or SILVERFISH

2b. No such projections from abdomen..... 3

3a. Legs or beginnings of legs..... 4

3b. No legs..... 15

4a. Legs which are used for locomotion..... 5

4b. Legs which are not used for locomotion (These are non-moving insects which are in the larva or pupa stage, or certain groups of insects which undergo a complete change in body structure and appearance during this stage, usually resembling adult forms)..... 18

5a. Head which is usually elongated, triangluar, and bearing a cylindrical beak which contains piercing, threadlike mouth parts: the piercing-sucking type..... 6

5b. Head which is usually more or less rounded, with jaws for chewing solid food rather than for sucking liquid food..... 7

6a. Body flattened from side and bristled; hind legs fitted for leaping; body up to 3/16" long; parasitic on mammals and some birds..... FLEA

6b. Body not flattened from side to side; body not hairy; up to 3/16" long; reddish brown; found in beds or in cracks in furniture. Sucks human blood..... BEDBUG

7a Three pairs of legs on thorax and false, unjointed legs on abdomen; looks like a caterpillar.....LEPIDOPTERA--BUTTERFLY or MOTH LARVA

7b Legs on thorax only..... 8

8a Hind legs fitted for leaping; antennae as long as body or longer; drumlike ears on legs (Exception: mole cricket has short antennae and digs with legs.)..ORTHOPTERA--CRICKET

8b Hind legs (and other legs) fitted for running; all legs of about same strength and shape..... 9

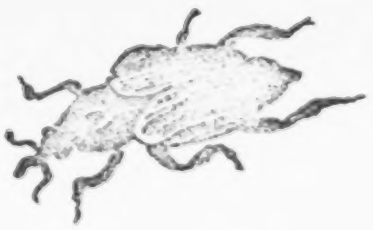
9a Body shaped like a twig with legs; long, threadlike antennae.....ORTHOPTERA--WALKINGSTICK

9b Body not shaped like a twig with legs....10

10a Antennae as long as body or longer; body oval, depressed, head almost horizontal and either entirely or almost hidden from view by prothorax; hard and shiny looking; found in dark places where food is prepared or under loose bark of dead trees or logs.....ORTHOPTERA--COCKROACH

10b Antennae not as long as body.....11

11a Head elongated to form a snout or beak with chewing mouth parts at the end of the beak.....COLEOPTERA--SNOUT BEETLE OR WEEVIL



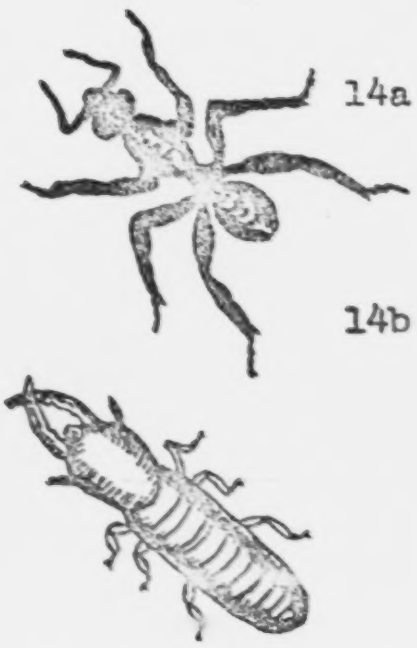
11b Head and mouth parts not as described in 11a.....12

12a Body caterpillar-like; three pairs of legs; hear hard, free, and usually colored, with strong jaws.....COLEOPTERA BEETLE LARVA

12b Body not caterpillar-like.....13

13a Huge mouth parts, biting claws; body is broad and somewhat flattened and tapers toward each end; found in small cone-shaped pits in sand; feeds on ants; up to 1/2" long.....NEUROPTERA--LARVA CALLED ANT LION

13b Without combination of huge biting jaws and flattened body.....14

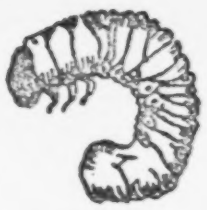


14a Thorax definitely separated from abdomen by a sharp, waistlike constriction, at which point there are one or two small knots or swellings.....HYMENOPTERA--WORKER ANT

14b Thorax not definitely separated from abdomen and without swellings; usually white or light in color; antlike in other respects; soldier caste has rectangular-shaped head which is hard and is equipped with huge jaws; insect never found in direct light.....ISOPTERA--TERMITE OF NON-REPRODUCTIVE CASTE

15a Biting mouth parts.....16

15b No biting mouth parts.....17

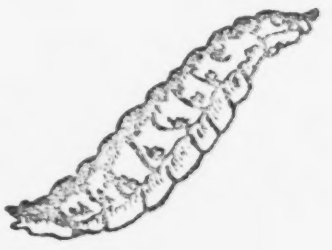


16a Head is hard, free, and usually colored brown or black with strong jaws; found in soil or on plants.....COLEOPTERA--LARVA OF BEETLE

16b Similar to 16a but jaws are not as strong and body is paler in color and softer; found in or on other insects as parasites or in cell in a colony, but also may be found on plants.....HYMENOPTERA--LARVA OF BEE, WASP, OR ANT

17a Breathing tube attached to last abdominal segment; abdomen very narrow; found just below surface of stagnant pond, with tube at surface.....DIPTERA--
LARVA OF MOSQUITO

17b No breathing tube; body may be slender, short, or thick but usually conical, soft, and white or light in color; mouth hooks in head but no jaws for biting; usually a conspicuous eyelike spiracle at the enlarged posterior end.....DIPTERA--
LARVA OF FLY



18a Legs and wings free from rest of body; body usually covered with envelope of silk or debris..HYMENOPTERA or COLEOPTERA--
PUPA

18b Legs and wings not free from body, but attached at all points.....39

19a Two wings plus tiny pair of knobbed, threadlike organs on the thorax just behind the wings.....DIPTERA--
FLY OR MOSQUITO

19b Four wings (2 pairs). Note: When front wings are horny and meet in straight line down middle of back or are thick and horny at base with membranous, overlapping tips, four wings may be assumed.....20

20a Front wings membranous, i.e., flexible, thin, and more or less transparent, like cellophane.....21

20b Front wings horny or leathery and opaque, i.e., hard like plastic or oilcloth.....23

21a Front and hind wings alike in texture, i.e , same degree of thickness or transparency.....27

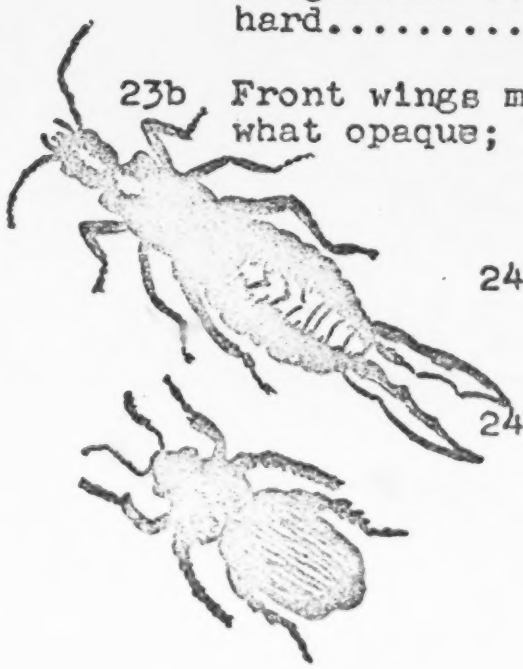
21b Front and hind wings not alike in texture; front wings thicker and not quite so transparent as hind wings.....22

22a First 2/3 or less of front wing (from point of attachment) thicker than rest of wing, which is membranous; these membranous tips overlap each other; head usually elongated and triangular, and bearing a cylindrical beak that contains piercing, sucking mouth parts and arises from front area of head.....HEMIPTERA--TRUE BUG

22b Front wings same thickness throughout and usually held rooflike over back; piercing, sucking mouth parts arising from rear area of head.....HOMOPTERA--SCALE BUGS, APHID, CICADA, LEAFHOPPER

23a Front wings horny and opaque, and meeting lengthwise down middle of back; body hard.....24

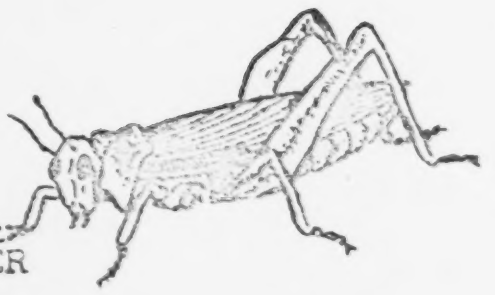
23b Front wings more or less leathery, somewhat opaque; body softer.....25



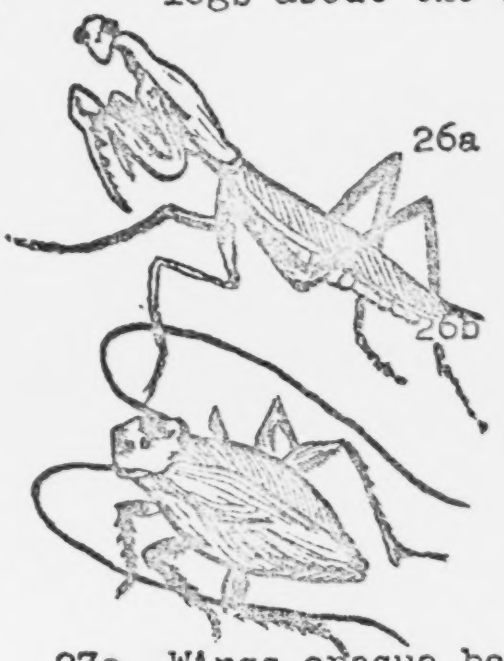
24a Pincer or forcep-like appendage on tip of abdomen.....DERMAPTERA--EARWIG

24b No pincer on abdomen.....COLEOPTERA--BEETLE

25a Hind legs fitted for leaping; mouth parts fitted for chewing solid food, i.e., on head which is usually more or less rounded, with jaws for chewing; front wings leathery, hind wings folded like plaited fan.....ORTHOPTERA--GRASSHOPPER



25b Hind legs not fitted for leaping--all legs about the same size and shape.....26



26a Body long and pencil-shaped; fore legs modified for grasping and holding its prey.....ORTHOPTERA--PRAYING MANTIS

26b Body flattened and oval; head almost horizontal and entirely or almost hidden from view by prothorax; hard and shiny looking with antennae as long as body or even longer.....ORTHOPTERA--COCKROACH

27a Wings opaque because of covering of minute flat, shinglelike scales that appear powdery when rubbed off.....28

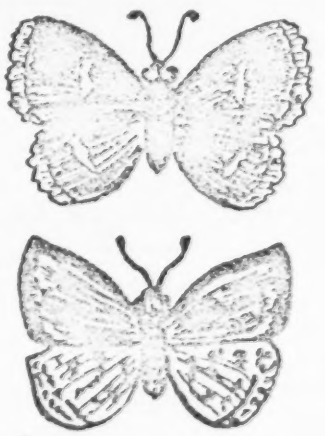
27b Transparent wings.....30

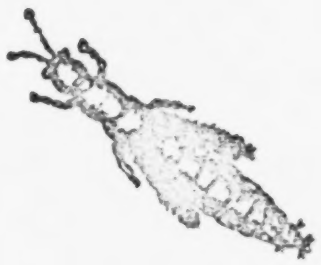
28a Antennae featherlike or threadlike; wings held horizontally at rest or folded around body.....LEPIDOPTERA--MOTH

28b Antennae not featherlike or threadlike; enlarged at tip to form a club or hook...29

29a Tip of antennae recurved.....LEPIDOPTERA--SKIPPER

29b Tip not recurved.....LEPIDOPTERA--BUTTERFLY





30a Wings long and narrow with only one or two longitudinal viens; both edges of wings fringed with hairlike bristles; body less than 1/8" long.....THYSANOPTERA--THRIP

30b Wings not fringed; mostly larger insects.31

31a Wings net-veined--like fish net or hair net; many longitudinal and cross veins which intersect in netlike fashion.....32

31b Wings with few longitudinal veins and few or no cross veins.....36

32a Front wings larger than hind wings.....33

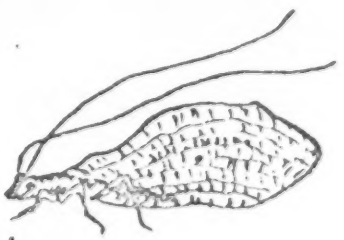
32b Hind wings larger or equal to front wings.....35

33a Antennae long and very conspicuous and greatly segmented; head prolonged downward to form a beak with chewing parts at tip; abdomen long and slender; wings long and narrow.....MECOPTERA--SCORPION FLY

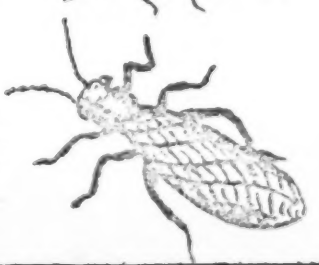
33b Antennae short and not conspicuous.....34

34a Wings triangular in shape; body ending in two or three long, slender, antennae-like appendages called cerci.....EPHEMERIDA--MAYFLY

34b Wings not triangular in shape; no cerci on abdomen; strong flyer.....ODONATA--DRAGONFLY



35a Wings held rooflike over back when at rest, lacy pattern of veins; cerci when visible are antennae-like.....NEUROPTERA--LACEWING

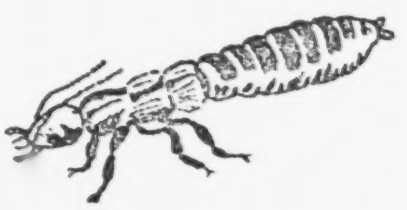


35b Wings lie flat on abdomen when at rest; body usually ending in two or three long cerci.....PLECOPTERA--STONEFLY

36a Wings held rooflike over back at rest....38

36b Wings lie flat on abdomen when at rest...37

37a Wings equal in size, shape, texture, and veins; wings long, extending beyond abdomen when at rest; wings lie flat on back; antlike in appearance; separation of thorax and abdomen not distinct.....
ISOPTERA--TERMITE OF REPRODUCTIVE CASTE



37b Wings not equal in size, shape, or veins; with the exception of sawfly, the abdomen and thorax are clearly separated by a constriction which forms a thin waist; female usually has a visible stinger (spearlike egg-laying organ); front and hind wings connected by minute hooks.....HYMENOPTERA--WASP

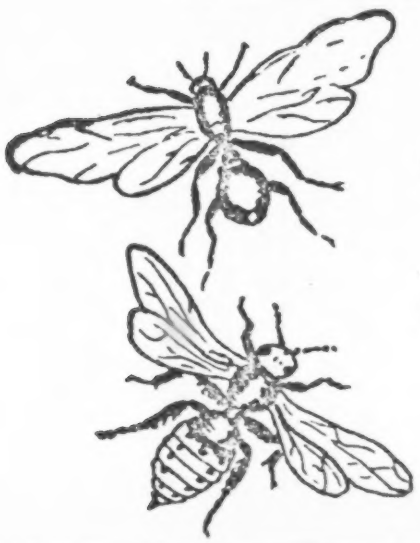
(See also couplet 40)

38a Hind wings almost as large as front wings; may appear to have hairy wings in some species.....TRICHOPTERA--CADDIS FLY

38b Hind wings much smaller than front wings; never hairy; seen on leaves of trees and on fences.....CORRODENTIA--PSOCID

39a Body encased in cover of silk (cocoon) .....LEPIDOPTERA--PUPA

39b Body encased in brown, oval segmented case or puparium.....DIPTERA--PUPA



40a Waist with one or two small knots or swellings.....HYMENOPTERA--REPRODUCTIVE ANT FORMS

40b Waist without small knots; usually a stinger or "saw" on abdomen of female .....HYMENOPTERA--BEE, WASP

HOW RESOURCES AFFECT EACH OTHER

	WATER	PLANTS	WILDLIFE	MAN
SOIL	Affects: Runoff Percolation into ground Underground storage Purity by filtration	Anchors plants, Supplies water & minerals Affects where plans grow by: topography, elevation, soil depth, acid or alkalinity of soil.	Affects where animals live because of topography, elevation, availability of water and types of plants which grow.	Affects: Productivity of soil Where man lives What he produces Economy based on location of resources Scenic value
	SOIL	PLANTS	WILDLIFE	MAN
WATER	Washes away soil Affects types of soil (swamp, desert) Helps break down soil by freezing, flowing, and seepage.	Affects: Transpiration Where plants grow--swamp, hillside, rainfall, fog, snow, etc.	Affects: Aquatic animals Where animals live by their need for water and food.	Provides scenic values, recreation Affects where man lives (floods, drought), what he grows on soil
	SOIL	WATER	WILDLIFE	MAN
PLANTS	Help rocks break into soil by root penetration Make organic fertilizer which enriches soils and absorbs water. Hold soil in place Protect soil from rainfall.	Make open spaces in soil for water penetration, tap roots Shade streams, keep water cool. Use water in transpiration Purify water.	Provide food, shelter; water in succulent plants for drinking. Give off 0_2 for breathing.	Provide: Forage for cattle, Shelter Necessities & luxuries of life Recreation and shade Scenic value
	SOIL	WATER	PLANTS	MAN
WILDLIFE	Make organic fertilizer Cause soil compaction Build beaver dams--percolate & hold H_2O in soil, prevent soil erosion.	Pollute water Build beaver dams--flood control, water storage.	Fertilize plants Carry seeds Give off CO_2 that plants need. Destroy plants.	Provide scenic value, recreation, hunting, fishing, livelihood in trapping Damage crops--Kill livestock
	SOIL	WATER	PLANTS	WILDLIFE
MAN	Increases & decreases soil productivity Causes soil erosion Puts new lands in production Changes face of earth Manages for his benefit.	Stores water in dams Pollutes water Diverts water Uses more water than available in some areas Manages for his benefit.	Grows new crops Eliminates natural plants Clears land of plants Harvests trees and grass Manages plants for his benefit.	Harvests wildlife and natural predators Upsets nature's cycle of animals Manages for his benefit.

INSTRUCTIONAL RESOURCES

BOOKS

An Approach to Conservation Education. Jefferson City: Missouri Department of Conservation.

Carson, Rachel. Silent Spring. New York: American Book Co., 1967.

Comstock, Anna B. Handbook of Nature Study. Ithaca: Cornell University Press, 1970.

Cornell Science Leaflets. Food Chains, Water Wonders, Winter Twigs, Decay, Fungi, Conservation, Plants. Ithaca: Cornell University Press, 1967.

Forest Trees of Missouri. Jefferson City: Missouri Department of Conservation.

Hogner, Dorothy C. Earthworms. Chicago: Thomas Y. Crowell, 1953.

Laum, C.H. Natural History Guide. Alton: Alsace Books and Films, 1967.

MacCracken, H. D., Brown R. A., Decker, D. G., Jackson, D. F., Sund, R. B. Science Through Discovery. New York: L. W. Singer Co., 1968.

MacCracken, H. D., Decker, D. G., Read, J. G., Yarian, A., Creswell, W. H. Life Science. New York: L. W. Singer Co., 1968.

Selsam, Millicent E. Behavior of Ants. New York: Harper and Row, 1967.

Sullivan, R., Mackey, J., Haan, A. Looking at the Simple Forms of Life. Chicago: Century Communications, 1969.

Syrocki, J. B. What is Soil. New York: Benefic Press, 1961.

FILMS (Available from St. Louis County Audio-Visual Department)

F53074 "A Land Betrayed"

F52810 "Adaption to Marine Environment"

F53042 "Air Pollution"

F52747 "Aquarium, The"

F52750 "Butterfly"

F53110 "Chickens"

F53060 "Cry of the Marsh" (Must be previewed)

F53114 "Ducks"

F53070 "Everglades, Conserving a Balanced Community"

F52836 "Family Camping"

F53046 "Frogs and How They Live"

F53072 "Great Barrier Reef"

F53075 "Heritage of Splendor"

F53061 "Instincts of an Insect"

F52753 "Life Story of the Grasshopper"

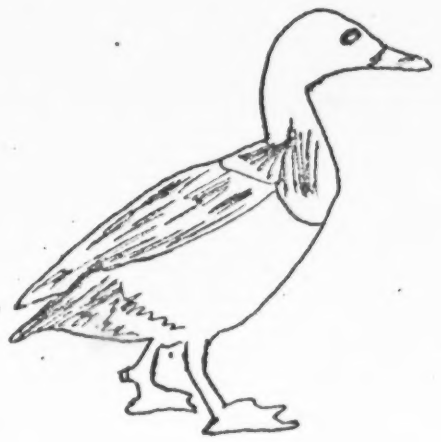
F53069 "Problems of Conservation"

F52752 "Problems of Conservation"

F53113 "Rabbits"

F52710 "Snakes and How They Live"

F53064 "Winged World--Instinct and Intelligence in Birds"



FLORISSANT PARKS

Groups must be 60% Florissant residents and adhere to park Rules and Regulations.

Florissant City Hall
619 St. Francois Street
921-5700

Bangert Park. 275 So. Florissant Road: 13 acres

Behlmann Park. Loekes Drive, entrance at Winsted Drive or Roanoke Drive: 7 acres.

Blackfoot Park. Canisius and Gonzaga Streets: 2 acres.

Champlain-Florval Park. Marquette and Queens Drives: 2 acres.

Duchesne Park. Brower Court off Graham Road at Christian Brothers Lane: 10 acres.

Dunegant Park. Derhake and Pohlman Road: 52 acres.

Koch Park. Charbonier and Howdershell Roads: 70 acres.

Loretta Manor Park. Patterson Road and Angelus Drive: 2 acres.

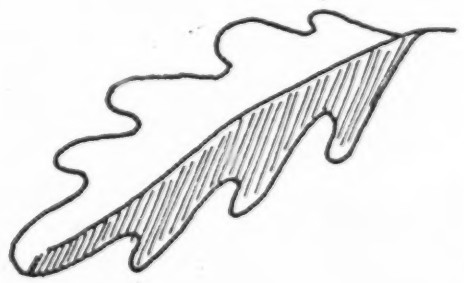
Mullanphy Park. Mullanphy and Night Drive: $9\frac{1}{2}$ acres.

Parker Road and Waterford Drive: 40 acres.

St. Ferdinand Park. St. Ferdinand Street north of Highway 140: 57 acres. Located in the park is St. Ferdinand Lake which is spring-fed.

Sunset Park. Intersection of Humes Lane and Shakelford Road: 55 acres. Located on the Missouri River Bluffs. Offers the opportunity to see a large expanse of the river, has the advantage of being situated on the Bluffs, and continues right down to the banks of the river.

Tower Court Park. No. Florissant Road and Washington Street: 2 acres.



FERGUSON PARKS

Groups must be 60% Ferguson residents and adhere to park Rules and Regulations.

Park, Recreation and Forestry Department
501 No. Florissant Road
521-4661

Dade Park. 414 Dade Avenue: 4.7 acres.

Forestwood Park. 825 Ferguson Avenue: 28 acres.

Hern Avenue Area. 5500 Hern Avenue: 5 acres.

Hudson Road Area. 1271 Hudson Road: 23 acres.

January-Wabash Park. 501 No. Florissant Road: 21 acres.

Fred B. Jeske Memorial Park. 211 Thoroughman: 7 acres.

Lang-Royce Park. 1200 Lang Drive: 5.5 acres.

Nesbit-Newton Park. 1550 Nesbit Drive: .5 acres.

Robert-Superior Park. 641 Robert Avenue: 5.5 acres.

Wayside Park. 1020 Chambers Road: 7 acres.